OCCASIONAL PAPERS* - No. 38 December, 1934.

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

PROFIT FROM IMPROVING A SECOND-GROWTH FOREST OF LOBLOLLY AND SHORTLEAF PINES AND HARDWOODS

By

Henry Bull, Assistant Silviculturist,

Southern Forest Experiment Station.

* - This series of publications releases data gathered in connection with investigations being carried on at the Southern Station. The information contained in them is subject to correction or amplification following further investigation. - Editor

PROFIT FROM IMPROVING A SECOND-GROWTH FOREST OF LOBLOLLY AND SHORTLEAF PINES AND HARDWOODS

By

Henry Bull, Assistant Silviculturist,
Southern Forest Experiment Station.

Forty-one percent, or 78 million acres, of the total commercial forest area in the South is characterized by the occurrence of shortleaf and/or loblolly pines in mixture with hardwoods. The shortleaf-loblolly-hardwood forest occupies a broad zone extending from southern Maryland to eastern Texas and in 1930 was estimated by the United States Forest Service to contain approximately 100 billion board feet or 51 percent of the total stand of sawtimber in the South. About 96 percent of this forest has been cut over at least once and now consists of second-growth pine and hardwood more or less intermixed with remnants of the original stand. The second-growth stands vary greatly in age, density, merchantable volume, and the number and proportion of commercially valuable species of good form and quality. Despite this variety of conditions, almost all of these stands could be greatly improved in present and prospective value by one or more of three kinds of partial cuttings, as follows:

1. Improvement cuttings --to remove or deaden (1) large unmerchantable trees that are suppressing smaller trees of desirable form and species, (2) the larger trees of unmerchantable or undesirable species, and (3) very crooked, knotty, unsound or dying trees of any species.

2. Thinnings --to reduce the crowding and competition in dense, more or less even-aged groups of desirable second growth, and to give increased growing space to selected trees.

3. Reproduction cuttings --to remove mature or overmature merchantable trees in order to cash in on their commercial value and to make room for reproduction which will insure future yields of wood products.

Individual stands may require only one or two of the above cuttings, but in general all three kinds of cuttings are needed in the improvement of any extensive stand of timber. The three kinds of cuttings are distinct in themselves, yet are easily and logically combined so that all three can be made in a single operation. In some stands the emphasis will be on one kind of cutting, in others on another kind. The average operation, however, will usually be especially concerned with improvement cuttings, and since the other two cuttings also improve the stands, the entire operation --combining any or all kinds --is conveniently referred to simply as an improvement cutting. The term is used in this broad sense in the remainder of this article.

Most second-growth stands of shortleaf and loblolly pine are in need of improvement cuttings because of the relative abundance of large trees that are at present unmerchantable because of their species or quality, and smaller trees that have no prospective merchantable value for the same reason. These trees, by their number and position, crowd and suppress merchantable or potentially merchantable

trees. The removal of undesirable trees from such stands is beneficial to the remaining trees just as weeding a potato patch is beneficial to the potatoes. An unweeded potato patch will grow potatoes, but neither as many nor as rapidly as if weeded. An unimproved second-growth stand will grow merchantable trees but neither as many nor as rapidly as a second-growth stand that has been given an improvement cutting. The benefits derived from improvement cuttings, however, can be assigned no definite or fixed value. Some stands are more susceptible to improvement than others. and some methods of improvement are more productive of results than others. In brief, one can confidently expect to benefit a stand by improvement cuttings but cannot easily predict the precise amount or value of the benefit.

Benefit to the stand alone, however, is not and should not be sufficient reason to the average owner of forest land for making indiscriminate improvement cuttings. He must also consider the immediate financial returns. If an improvement cutting costs $1 per acre and will return an indefinite benefit that may prove to be worth less than $1 per acre, the average owner cannot be expected to undertake the risk. In the absence of complete and reliable data on specific economic benefit --which no matter how carefully compiled will include estimates, not facts, of future prices --most forest-land owners cannot be expected to make improvement cuttings unless they can at least break even financially. If the operation is profitable in itself, at the moment, any benefit accruing to the stand is just so much to the good. If the operation is conducted at neither immediate profit nor loss, any benefit to the stand is also just so much to the good provided the owner's capital and labor could not have been more profitably employed elsewhere. In the final analysis, then, an improvement cutting must either break even or produce a profit--or it will probably not be made.

The need and desirability of improvement cuttings in second-growth stands of loblolly and shortleaf pine have been pointed out. The question is: Can they be made to return a profit? A case study of one that did return a profit is outlined briefly in the following pages.

The cutting was made by the Southern Forest Experiment Station on land of The Urania Lumber Company near Urania, LaSalle Parish, La. It is interesting to note that this company, under the leadership of Hon. Henry E. Hardtner, was the first to qualify, under the Lumber Code (Article VIII-k) for the additional 10 percent lumber-production allotment granted to companies whose forest lands are managed on a sustained-yield basis. Detailed records of the work and its immediate financial aspects were made. The experimental area constitutes a permanent sample plot, but the details of establishment technique will not be considered here. Only the more important facts concerning the stand, its treatment, and the cash costs and cash returns will be stated. These facts, in outline form for ready reference and classification, are as follows:

(1) Location and accessibility: Near Urania, La., adjacent to a graveled State highway by which it is 5.8 miles to the company lumber mill and only 0.6 mile from a railroad spur on which pulpwood can be loaded for delivery to a kraft paper mill about 75 miles distant.

(2) Area: 15.5 acres, of which 7.75 acres were given the improvement cutting.

(3) Stand before cutting:

(a) Type, age, and condition: Loblolly-shortleaf-hardwoods, in rather ragged and generally understocked condition. The original timber had been cut about 30 years previously and the present stand is composed largely of second-growth pine about 25 to 30 years old, intermixed with large hold-over pines and hardwoods. The stand as a whole needs all three classes of cutting described in the first paragraph of this article.

(b) Stand table: The more important data are presented in Table 1, where it will be noted that there is a surplus of smaller pine and a scarcity of larger pines.

Table 1.- Average stand per acre before improvement cutting

Diameter-breast-high class (Diameter at 4½ feet from the ground)	Number of trees		Merchantable volume		
	Pines	Hardwoods	Board feet[1]		Cords of pulpwood[2]
			Pines[3]	Hardwoods	Pines[3]
Inches					
1- 3	161	305	-	-	-
4- 7	221	73	-	-	4
8-11	43	7	-	-	4
12-17	16	8	2,734	-	-
18-24	4	4	1,430	96	-
25-31	-	1	-	-	-
Total	445	398	4,164	96	8

[1] International ¼-inch rule.

[2] Cords of 144 cubic feet (4½ x 4 x 8 feet) were used to conform to local practice.

[3] Of the pines, loblolly accounts for 89 percent and shortleaf for 11 percent of the total volume.

(4) Specific object of cutting: To improve the composition and the growth in volume and quality, and to make the first step toward sustained yield of pine sawtimber by adjustment of the number of trees in the various diameter-breast-high classes. The stand was very deficient in the larger size classes (10 inches in diameter breast-high and larger) but had a surplus of the smaller size classes (from 2 to 9 inches in diameter breast-high), hence by heavy cuttings in the latter a process of correction was initiated. The improvement of the growth capacity was accomplished by improving the position of individual selected trees, and not by indiscriminate cuttings favoring no specific individuals.

(5) Method of cutting: The marking rules were very elastic and the general governing principles were frequently modified to fit local requirements. They may be summarized as follows:

Diameter breast high	Pines	Hardwoods
Inches		
Under 4	Cut nothing.	Cut nothing.
4	Cut only trees that seem certain to die before next cutting, in 5 to 10 years.	Cut nothing.
5-7	Cut freely, removing the poorer competing trees from around selected crop trees, and very poor trees from any position. Aim to give crop trees increased growing space for next 5 to 10 years . Crop trees were selected on the basis of good size, form, and vigor rather than of spacing.	Cut nothing, except an occasional bushy-crowned tree of poor form or species crowding a crop tree.
8-14	Cut sparingly, removing only the very poorest, most crowded, knottiest, and most unsound trees.	Cut or deaden occasional 8 to 9-inch trees as above. Cut or deaden all 10 to 14-inch trees of undesirable or unmerchantable species, form, or condition, or where crowding more valuable trees.
15 and over (Mature)	Cut trees the removal of which will apparently benefit the stand beyond their probable increased value if left. Size, quality, apparent or known growth rate, position, and the necessity of leaving enough trees for a similar cut in 5 to 10 years are factors to consider. This is the most difficult part of the marking.	Cut for sawlogs, or deaden, all trees except unusually fine trees which will increase greatly in value. (Few sawlogs were cut from this class and only two trees were considered good enough to leave).
15 and over (Overmature and defective. Frequently wolf-trees.)	Cut everything.	Cut for sawlogs, or deaden, everything.

In general, pines from 4 to 13 inches in diameter breast-high were cut into pulpwood and pines 14 inches and over in diameter breast-high were cut into sawlogs. The relatively small, knotty tops of sawlog trees were cut into pulpwood rather than No. 3 sawlogs. Hardwoods were deadened by girdling, i. e., by cutting a notch 1 to 2 inches deep into the sapwood, completely around each tree at about waist height.

The reasoning that led to the marking rules for trees in and below the 4-inch class is as follows: Four-inch pines contain very little pulpwood and an increase in diameter of only an inch or two results in a greatly increased pulpwood yield. If a 4-inch pine that is left standing should grow very slowly or die, it can hardly offer serious competition to larger trees during its life; and its loss through death has no appreciable effect on the total yield of pulpwood. On the other hand, if a 4-inch pine increases an inch or more in diameter before the next cutting, its possible effect in hindering the growth of larger trees is probably more than compensated by its own increased yield. Small hardwoods were not cut because (1) they were unmerchantable, (2) they did not offer much serious competition to the pines, (3) they contained a small proportion of potentially merchantable trees, and (4) they probably have a very desirable silvicultural influence on the stand through their effect in hastening natural pruning of crop trees and in enriching the soil with leaf litter.

(6) Stand removed in the improvement cutting: The application of the marking rules resulted in the cutting and deadening of the material listed in Table 2. Trees cut or knocked down in the logging operation are also included. Calculations made after the cutting showed that if the small, knotty tops of sawlog pines had been cut into No. 3 logs to about a 6-inch diameter inside the bark, instead of into pulpwood, an additional 375 board feet (International 1/4-inch rule) per acre could have been obtained at the sacrifice of about 0.35 cord of pulpwood per acre, with a resultant increased net profit of about 50 cents per acre in 1933.

Table 2. - Stand per acre cut or deadened in the improvement cutting

Species	Diameter breast high	Number of trees		Merchantable volume removed			
				Board feet		Cords (144 cubic feet)	
		Cut	Deadened	Doyle	International 1/4-inch	From entire trees	From tops of sawlog trees
	Inches						
Pines	12 and over	5	0	728	1,000	0.2	0.4
Pines	8 to 11	9.5	0	0	0	0.8	-
Pines	4 to 7	65	0	-	-	1.6	-
Pines	1 to 3	4	0	-	-	-	-
Hardwoods	10 and over	0.5	15	76	96	-	-
Hardwoods	1 to 9	24	0	-	-	-	-
Total		108	15	804	1,096	2.6	0.4

(7) Financial aspects: The financial outcome of the operation was calculated with costs based on actual time spent at prevailing wages per hour and returns based on prevailing prices. Since the cutting was made in March and April, 1933, the costs were considerably lower and the returns were slightly lower than they would have been if the cutting had been made about one year later. The financial outcome if the cutting had been made in the summer of 1934, paying wages prescribed by the Lumber Code, has therefore been calculated for comparison. The net results are different, but the operation is definitely profitable to the owner in both instances. In the following financial statement, the itemized labor costs in man-hours are included so that the final balance may be calculated for any scale of wages and prices.

FINANCIAL STATEMENT

	Labor in man-hours per acre	Cash costs and returns per acre (at prevailing wages and prices) Spring, 1933 Costs	Spring, 1933 Returns	Summer, 1934 Costs	Summer, 1934 Returns
REMOVAL OF SAWLOGS (av.: 1,096 bd. ft., International 1/4-inch rule or 804 bd. ft., Doyle rule, per acre (costs and returns based on Doyle rule)		---------- Dollars ----------			
Value delivered at the mill[1]			5.43		6.03
Cost of felling and bucking	2.1	0.42		0.67	
Cost of skidding (average, 200 feet, with mules)	0.8	0.32		0.48	
Cost of hauling to mill (5.8 miles on gravel in 1-1/2-ton truck)	1.2	1.08		1.80	
Cost of supervision and marking (est.)	0.3	0.09		0.12	
Margin for stumpage and profit			3.52		2.96
REMOVAL OF PINE PULPWOOD FROM WHOLE TREES CUT ENTIRELY INTO PULPWOOD (average: 2.6 cords per acre)					
Value delivered in freight car[2]			7.09		7.09
Cost of felling, bucking, splitting, and piling	15.7	2.52		4.44	
Cost of hauling to gravel road (average, 500 feet with 1/2-ton truck)	0.6	0.42		0.60	
Cost of hauling on gravel road to railroad (0.6 mile with same 1/2-ton truck)	0.3	0.21		0.30	
Cost of loading in woods and at R.R.	3.0	0.37		0.72	
Cost of supervision and marking (est.)	1.2	0.36		0.48	
Margin for stumpage and profit			3.21		0.55
REMOVAL OF PINE PULPWOOD FROM TOPS OF SAWLOG TREES (av.: 0.4 cord per acre)					
Value delivered in freight car[2]			1.24		1.24
Cost of bucking, splitting, and piling	3.4	0.56		0.99	
Cost of hauling to gravel road (average, 500 feet with 1/2-ton truck)	0.2	0.14		0.20	
Cost of hauling on gravel road to railroad (0.6 mile with same 1/2-ton truck)	0.1	0.07		0.10	
Cost of loading in woods and at R.R.	0.7	0.09		0.17	
Cost of supervision (estimated)	0.1	0.03		0.04	
Net profit			0.35		-0.26(loss)
Total margin for stumpage and profit from removal of sawlogs and pulpwood			7.08		3.25
Cost of deadening worthless hardwoods (average: 15.4 trees per acre, 10 inches and over in d.b.h.)	1.4	0.18		0.34	
STUMPAGE REALIZATION, OR FINAL TOTAL NET PROFIT IF THE OPERATOR IS ALSO THE OWNER AND IS CUTTING HIS OWN STUMPAGE			6.90		2.91

(SEE FOOTNOTES ON FOLLOWING PAGE)

[1] Based on 1933 prices, per M.B.M. (Doyle), of $8.00 for No. 1 logs, $6.00 for No. 2 logs, and $4.00 for No. 3 logs, and 1934 prices of $9.00, $6.50, and $4.50, respectively.

[2] Based on 1933 and 1934 prices of $2.75 per 144-cu.-ft. cord.

Comments

Few operators would buy stumpage that could be removed only in an improvement cutting. If an operator did buy this stumpage in 1933 or 1934, he would pay, at most, $2.41 per acre for the sawlogs (at $3 per MBM, Doyle rule) and $1.29 per acre for the pulpwood stumpage (at $0.50 per cord). These average stumpage prices apply to trees of considerably higher average quality than the trees removed in the improvement cutting, hence if the stumpage were actually bought the prices should be less than those quoted. Deducting the maximum of $3.70 for stumpage ($2.41 + $1.29) from the final net margins for stumpage and profit shown in the financial statement, it is evident that there would be a net profit of $3.20 per acre in 1933 and a net loss of $0.79 per acre in 1934.

Ordinarily, however, improvement cuttings will be made only by the owner of the stand. The financial statement shows that the owner would have made a net profit of $6.90 per acre in 1933, and a net profit of $2.91 per acre in 1934, since he already owns the stumpage and is cashing in or realizing on it. It is important here to note that if the owner does not make an improvement cutting, and leaves the stand for a later and heavier logging, the $3.70 worth of stumpage that could have been removed will decrease steadily and tend ultimately to vanish entirely. The reason is simply that the greater part of the $3.70 stumpage is in poor trees that will deteriorate or die before the stand is logged. Most of the sawlog stumpage will deteriorate in quality through increase in rot, and much of the pulpwood stumpage will die from suppression.

The total of 1.6 man-hours per acre estimated for marking and supervision could be greatly reduced in an extensive operation after the crews become accustomed to the method of cutting, since they could then cut without preliminary marking and with a minimum of supervision.

The stand will undoubtedly benefit from the cutting. Just how much can not and need not be determined at the present time. The important point is that the improvement cutting removed a very small merchantable volume per acre, yet returned a profit to the owner. Therein lies food for thought by owners and managers of similar stands.